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(54) A shake preventing construction for a terminal fitting and connector

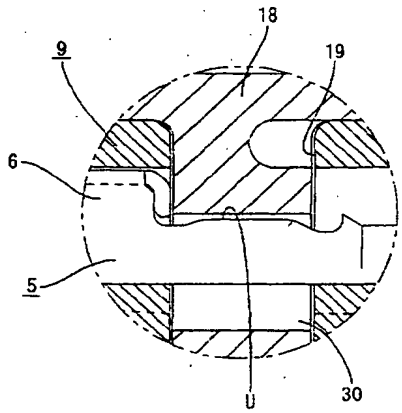
(57) [Object]

To prevent a fine sliding abrasion between terminal fittings.

[Solution]

When a terminal retainer 15 is mounted in a full locking position in a housing 9, a terminal locking portion 18 formed on the terminal retainer 15 comes into contact with the upper edges of receiving pieces U of female terminal fittings 5. Since the female terminal fittings 5 are so held as not to shake in cavities 16, a problem of fine sliding abrasion can be solved. Further, since the receiving piece U is formed before barrel portions 12, 13, it is not influenced by a variation of the outer diameter of a wire W to be connected. Therefore, the terminal locking portion 18 can be securely brought into contact with the receiving pieces U. Moreover, the terminal retainer 15 is integrally or unitarily formed with a terminal locking portion 18 for engaging connecting portions 6 of the female terminal fittings 5 for locking. Since a spacing between the terminal locking portion 18 and the front-stop wall 28 is set equal to the entire length of the connecting portions 6 of the female terminal fittings 5, the terminal locking portion 18 can be engaged with the rear ends of the connecting portions 6 while being held in close contact therewith.

FIG. 19



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Description

[0001] The present invention relates to a connector and a construction for preventing a terminal fitting from shaking in a connector housing.

[0002] A conventional connector housing is such that a cavity penetrates it in forward and backward directions and a terminal fitting is inserted into the cavity from behind. Further, an elastic locking piece called a "lance" is generally formed in the bottom wall of the cavity, and the terminal fitting is engaged with the leading end of the elastic locking piece to be held.

[0003] In a connector used in an environment subjected to vibration such as in an automotive vehicle, there has been a problem of fine sliding abrasion that, when vibration is transmitted to terminal fittings, male and female terminal fittings are rubbed against each other at a high speed, thereby abrading contact portions. Since this fine sliding abrasion can be restricted by preventing the terminal fittings from shaking in cavities, suitable members may be held in contact with the terminal fittings to prevent the shake.

[0004] Some of known connectors solved the fine sliding abrasion by such a method. For example, a barrel portion of the terminal fitting for the connection with a wire is utilized and pressed, or an insulation coating of the wire is pressed.

[0005] However, the above known connectors still have problems to be solved. Specifically, the same terminal fitting may be used to connect wires having a plurality of different diameters. In such a case, a contact member for pressing the wire itself has variable contact states with the wire and may not be held in contact with the wire depending upon the diameter of the wire. Likewise, a contact member to be held in contact with the barrel portion may not be held in contact with the barrel portion depending upon the diameter of the wire since the barrel portion is crimped into connection with a core or an insulation coating of the wire and the height of the upper end of the crimped barrel portion varies depending on the diameter of the wire. If the above situations arise, the problem of fine sliding abrasion cannot be solved.

[0006] Furthermore, a connector for securely locking terminal fittings accommodated in a connector housing so as not to come out by two kinds of locking means including elastic locking pieces and a retainer is known. An example of such is the one disclosed in Japanese Unexamined Patent Publication No. 11-204185. The construction of this connector is briefly described with reference to FIG. 20. A terminal 50 is accommodated in a cavity 52 formed in a connector housing 51, and the front end thereof is stopped by a front wall 53 of the cavity 52. A cantilever-shaped locking portion 54 formed at the bottom wall of the cavity 52 is elastically engageable with a bottom side of the terminal 50 for locking, and a retainer 55 mounted on the upper surface of the connector housing 51 is engageable with the upper surface of the terminal 50 for locking, so that the terminal 50 is securely prevented from coming backward out of the cavity 52.

[0007] However, the above construction had a problem that the terminal 50 shakes in the cavity 52, caused by the following. First, the locking portion 54 is elastically deformed downward when the terminal 50 is inserted. At this time, an engaging position of the locking portion 54 moves in an arc. Accordingly, the engaging position of the locking portion 54 differs in horizontal direction by a specified distance between a position where the locking portion 54 permits the terminal 50 to pass and a position where it is elastically restored to its original shape to lock the terminal 50. This creates a clearance between the terminal 50 and the locking portion 54 in a state where the terminal 50 is locked by the locking portion 54, although this clearance is very small.

[0008] Since the retainer 55 is mounted by pushing straight into the connector housing 51, no clearance is formed for the same reason as the locking portion 54. However, since the retainer 55 is formed separately from the connector housing 51 unlike the locking portion 54, it is unavoidable to create clearances (a) and (b) at a retainer mount position in the connector housing 51 from a manufacturing or assembling ground when the retainer 55 is assembled with the connector housing 51. Thus, the mount position of the retainer 55 varies in forward and backward directions because the retainer 55 is assembled with the connector housing 51, which results in clearances between the terminal 50 and the retainer 55.

[0009] As described above, the prior art locking construction cannot avoid the shape of the terminal 50 in the cavity 52. If such a connector is used in an automotive vehicle and vibration from the vehicle is transmitted thereto, the terminals shake at a high speed and male and female terminals may be abraded due to fine sliding or the like.

[0010] The present invention was developed in view of the above problems and an object thereof is to hold a terminal so as not to shake in a cavity.

[0011] This object is solved according to the invention by a shake preventing construction according to claim 1 and by a connector according to claim 9. Preferred embodiments of the invention are subject of the dependent claims.

[0012] According to the invention, there is provided a shake preventing construction for a terminal fitting, comprising:

at least one terminal fitting formed at its rear part or one end portion with a wire connecting portion to be connected with a wire,

a connector housing provided with at least one cavity for at least partly accommodating the terminal fitting, and

a terminal fixing device mountable in the connector housing and having a contact portion for coming in-

to contact with the terminal fitting in a position before or near the wire connecting portion to prevent the terminal fitting from shaking.

[0013] Accordingly, when the terminal fixing device is mounted in the connector housing, the terminal fitting is prevented from shaking by the contact portion coming into contact with the terminal fitting accommodated in the cavity, with the result that a problem of, e.g. fine sliding abrasion with a mating terminal can be solved.

[0014] In order to prevent the terminal fitting from shaking in the cavity, the contact portion may be brought into contact in any position of the terminal fitting or an intermediate position of the wire. However, according to claim 1, the position of contact of the terminal fitting with the contact portion is set at a position before the wire connecting portion. This is because the diameters of wires to be connected with the same kind of terminal fittings differ. If the position of contact is set at the wire or a portion of the terminal fitting relating to connection with the wire, a contact state with the contact portion is not constant, with the result that a problem of shaking cannot be securely solved. However, if the position of contact is set before the wire connecting portion as proposed by the invention, the terminal fitting can be securely prevented without raising such a problem.

[0015] According to a preferred embodiment of the invention, the terminal fixing device comprises a locking portion for locking the terminal fitting to prevent the terminal fitting from coming out of the cavity.

[0016] Accordingly, the terminal fixing device functions to prevent the terminal fitting from shaking by means of the contact portion and preferably to lock the terminal fitting so as not to come out by means of the locking portion.

[0017] Preferably, the terminal fixing device is formed with a front-stop wall with which the front end surface of the terminal fitting is brought or bringable into contact for determining a front end position of the terminal fitting.

[0018] Accordingly, the terminal fixing device functions to prevent the terminal fitting from shaking by means of the contact portion and to determine the front end position of the terminal fitting by the contact of the front-stop wall with the front end surface of the terminal fitting.

[0019] Further preferably, the terminal fitting comprises a connecting portion to be connected with a mating terminal fitting, and a receiving piece, which can be brought into contact with the contact portion, between the connecting portion and the wire connecting portion.

[0020] Accordingly, when the terminal fixing device is mounted in the connector housing, the shake of the terminal fitting is prevented by the contact of the contact portion and the receiving piece.

[0021] Still further preferably, at least one of the terminal fitting and the contact portion of the terminal fixing device are formed with a guide surface for guiding a locking operation of the terminal fixing device.

[0022] Further preferably, the terminal fixing device can be positioned in a partial lock position at least one communication hole provided therein is substantially in flush with the corresponding cavity whereby the terminal fitting can be inserted into the cavity and the communication hole, whereas when the terminal fixing device is positioned in a full locking position the contact portion comes into contact with the terminal fitting thereby locking the terminal fitting in the cavity.

[0023] Further preferably, corresponding portions of one contact portion enter at least two adjacent or neighboring cavities (adjacent along the direction of insertion of the terminal fixing device) when the terminal fixing device is positioned in the full locking position. Further preferably, corresponding opening edge(s) of the communication hole enter the cavity when the terminal fixing device is positioned in the full locking position.

[0024] Most preferably, the terminal fitting is provided with locking means interacting with mating locking means provided in the connector housing so as to provide secondary locking means for locking the terminal fitting in the connector housing.

[0025] According to the invention, there is further provided a connector provided with at least one shake preventing construction according to the invention or an embodiment thereof.

[0026] According to the invention, there is further provided a connector, in particular having a shake preventing construction according to the invention or an embodiment thereof, comprising:

at least one terminal fitting formed with a engaging portion in a position spaced or away backward from a leading end thereof by a specified (predetermined or predeterminable) distance,
a housing having at least one cavity for at least partly accommodating the terminal fitting along its longitudinal direction, and
a terminal retainer (as a preferred terminal fixing device) at least partly mountable into the housing, having a movement-stop or front-stop wall which is to be located substantially at the front end of the cavity and is to be held substantially in contact with the leading end of the terminal fitting, and integrally or unitarily provided with a terminal locking portion which is located at a position spaced or away backward from the front-stop wall by a specified (predetermined or predeterminable) distance and engageable with the engaging portion.

[0027] According to a preferred embodiment of the invention, the cavity is formed with an opening for substantially exposing the engaging portion to the outside.

[0028] Preferably, the specified distance by which the engaging portion is spaced from the leading end of the terminal fitting and the specified distance by which the locking portion is spaced from the front-stop wall is substantially the same.

[0029] According to a further preferred embodiment, there is provided a connector, comprising:

a terminal fitting formed with a engaging portion in a position away backward from the leading end thereof by a specified distance,
a housing having a cavity for accommodating the terminal fitting along its longitudinal direction, the cavity being formed with an opening for exposing the engaging portion to the outside, and
a terminal retainer mountable into the housing, having a front-stop wall which is to be located at the front end of the cavity and held in contact with the leading end of the terminal fitting, and integrally or unitarily provided with a terminal locking portion which is located at a position away backward from the front-stop wall by the specified distance and engageable with the engaging portion.

[0030] Accordingly, since the terminal retainer is integrally or unitarily provided with the front-stop wall and the terminal locking portion, a distance between the front-stop wall and the terminal locking portion can be securely set substantially equal to a distance between the leading end of the terminal fitting and the engaging portion. Thus, a dimensional variation in forward and backward directions from a manufacturing or assembling ground which is found in the prior art can be made smaller and, therefore, the shake between the terminal fitting and the terminal locking portion can be maximally suppressed. As a result, this connector can be effective against fine sliding abrasion, etc.

[0031] Preferably, the engaging portion of the terminal fitting and/or the terminal locking portion of the terminal retainer is formed with a guide surface for guiding a locking action of the terminal locking portion of the terminal retainer.

[0032] Further preferably, the engaging portion of the terminal fitting is formed with a guide surface for guiding a locking action of the terminal locking portion of the terminal retainer.

[0033] Accordingly, the terminal locking portion smoothly performs its locking action by being guided by the guide surface when the terminal locking portion of the terminal retainer is engaged with the engaging portion of the terminal fitting.

[0034] Further preferably, the terminal retainer is movable between a partial locking position where it is held in the housing so as not to hinder insertion of the terminal fitting into the cavity and a full locking position where the terminal locking portion is substantially engaged with the engaging portion of the terminal fitting to prevent the terminal fitting from coming out of the cavity, preferably backwardly.

[0035] Most preferably, the terminal fitting comprises a connecting portion at the leading end thereof for the connection with a mating terminal fitting, the connecting portion defining the specified distance and comprising the engaging portion.

[0036] These and other objects, features and advantages of the present invention will become more apparent upon a reading of the following detailed description and accompanying drawings in which:

FIG. 1 is a side view in section showing a male connector housing and a female connector housing according to a preferred embodiment of the invention in its full locking position,
FIG. 2 is a side view in section of a female terminal fitting,
FIG. 3 is an enlarged view showing a contact piece of the female terminal fitting,
FIG. 4 is a front view of the housing,
FIG. 5 is a side view in section of the housing,
FIG. 6 is a plan view of the housing,
FIG. 7 is a front view of a housing head,
FIG. 8 is a plan view in section of the housing head,
FIG. 9 is a front view of a terminal retainer,
FIG. 10 is a side view in section of the terminal retainer,
FIG. 11 is a plan view of the terminal retainer,
FIG. 12 is a side view in section showing an insertion process of the terminal fitting when the terminal retainer is in a partial locking position,
FIG. 13 is a side view in section showing a completely inserted state of the terminal fittings,
FIG. 14 is a plan view in section of the female connector housing,
FIG. 15 is a front view in section of the female connector housing in its partial locking position,
FIG. 16 is a front view in section of the female connector housing in its full-locking position,
FIG. 17 is an enlarged section showing partial and full locking states of a first locking portion,
FIG. 18 is an enlarged section showing partial and full locking states of a second locking portion,
FIG. 19 is an enlarged section showing a contact state of a terminal locking portion and a receiving piece, and
FIG. 20 is a section showing a prior art connector.

[0037] Hereinafter, one preferred embodiment of the present invention is described with reference to the accompanying drawings. FIG. 1 shows male and female connector housings F, M of this embodiment. The male connector housing M is preferably in the form of a substantially rectangular tube open forward, and a plurality of male terminal fittings 1 are pressed preferably into its back wall. Each male terminal fitting 1 extends out of the male connector housing M and is preferably bent down at right angles in an intermediate position of its section outside the male connector housing M, and the leading end thereof is or can be connected e.g. with a wiring on a printed circuit board. A recess 2 is formed at the opening edge in the center of the upper surface of the male connector housing M, and an engaging projection 3

projects downward or towards an inner of the male connector housing M at the back of the recess 2 so as to be engageable with a locking projection 4 of the female connector housing F.

[0038] Next, one or more female terminal fittings 5 to be accommodated in the female connector housing F are described with reference to FIG. 2. A connecting portion 6 preferably in the form of a substantially rectangular tube is formed at the leading end of each female terminal fitting 5, and is insertable into or connectable with the male (mating) terminal fitting 1 when the female and male connector housings F, M are connected or mated. An elastic piece 7 preferably having a substantially triangular cross section is folded back or formed at the front end of the bottom wall inside the connecting portion 6, and is designed to elastically come into contact with the male terminal fitting 1 to establish an electrical connection therewith. An engaging projection 8 integrally or unitarily projects from the bottom surface of the connecting portion 6 and is engageable with a locking portion 10 of a housing 9 to be described later. Further, a contact piece 11 as shown in FIG. 3 is provided at the rear end of the connecting portion 6. This contact piece 11 is preferably formed by bending an upper end of the connecting portion 6 at its rear end downward or inwardly, and a downwardly or inwardly sloped or slanted or tapered guide surface 11a is formed on the upper surface of the bent portion for guiding a locking operation of a terminal retainer 15 (as a preferred terminal fixing device) of a terminal locking portion 18.

[0039] Behind the connecting portion 6 are provided a wire barrel portion 12 to be crimped or bent or folded into connection with a core of a wire W and then an insulation barrel portion 13 to be crimped or bent or folded into connection with an insulation coating of the wire W. The upper edges of a pair of opposing side walls between the connecting portion 6 and the wire barrel portion 12 serve as receiving pieces U. Each receiving piece U is formed to substantially horizontally extend along longitudinal direction, and can be brought into contact with the terminal locking portion 18 of the terminal retainer 15 to be described later.

[0040] The female connector housing F of this embodiment is comprised of the housing 9, a housing head 14 and the terminal retainer 15.

[0041] First, the housing 9 is described with reference to FIGS. 4 to 6. A main body 17 of the housing 9 is substantially in the form of a laterally long rectangular parallelepiped, and a plurality of cavities 16 for accommodating the female terminal fittings 5 while holding them in close contact over their entire circumference are provided substantially side by side in widthwise direction at upper and lower stages. The vertically or radially or laterally deformable locking portion 10 is formed in the bottom surface at the front end of each cavity 16. The locking portion 10 is deformed when the female terminal fitting 5 is inserted into the cavity 16, thereby permitting the passage of the female terminal fitting 5, while being restored substantially to its original shape after the passage of the female terminal fitting 5 to be engaged with the engaging projection 8 thereof.

[0042] A mount hole 19 into which the terminal locking portion 18 of the terminal retainer 15 is at least partly fittable is open from the upper or lateral surface to the opposite side surfaces of the main body 17 of the housing 9. This mount hole 19 is formed such that the rear end surfaces of the contact pieces 11 and the front opening edge of the mount hole 19 are substantially in flush with each other when the female terminal fittings 5 are properly accommodated in the housing 9. Further, partial and full locking projections 8a, 8b for locking the terminal retainer 15 project at different height positions of the opposite outer surfaces of the main body 17 on the opposite side of the mount hole 19. In this embodiment, the pair of partial locking projections 8a and the pair of full locking projections 8b are diagonally arranged or longitudinally displaced with respect to each other as shown in FIG. 6.

[0043] A bulging portion 20 is so formed at the front end of the main body 17 as to substantially surround the front parts of the respective locking portions 10. The bulging portion 20 is open forward and upward, and the housing head 14 to be described later can be accommodated in a spaced defined by the opposite side surfaces and the bottom surface of the bulging portion 20. Notches 21 for preventing the housing head 14 from disengaging are formed at the lower corners of the opposite side surfaces of the bulging portion 20.

[0044] An operable portion 22 used to connect and disconnect the female and male connector housings F, M bulges out at the rear end of the main body 17. Further, a pair of guide grooves 33 are formed in longitudinal direction in the inner surfaces of the opposite side portions of the operable portion 22. Coupling projections 34 of the terminal retainer 15 are slidably inserted or fitted into the guide grooves 33 to couple the housing 9 and the terminal retainer 15 or to connect the inner and outer housings.

[0045] The housing head 14 (see FIGS. 7 and 8) is so formed that it can be aligned with the back surface of the bulging portion 20 when being accommodated in the bulging portion 20 of the main body 17, and is formed with windows 23 which can communicate with the corresponding cavities 16, i.e. is lattice-shaped as a whole. A hooking projection 24 projects at the bottom end of each of the opposite side surfaces of the housing head 14. The hooking projections 24 are or can be engaged with the notches 21 of the bulging portion 20 when the housing head 14 is accommodated into the bulging portion 20 from front, thereby preventing the housing head 14 from disengaging upward.

[0046] Next, the terminal retainer 15 is described with reference to FIGS. 9 to 11. The terminal retainer 15 is substantially in the form of a box which is open downward or laterally and backward or longitudinally, so that it can be fitted into the housing 9 from above. A lock arm

25 for locking the female and male connector housing F, M into each other is arranged in forward and backward directions on the upper surface of the terminal retainer 15, and the locking projection 4 projects in a position slightly more forward than the center of this upper surface. The rear end of the lock arm 25 is connected with the upper surface of the terminal retainer 15, whereas the front end thereof is connected with protection walls 26 projecting or standing substantially in parallel at the opposite sides of the lock arm 25. Accordingly, the lock arm 25 is supported at its front and rear ends, and the locking projection 4 is engageable with the engaging projection 3 of the male connector housing M for locking upon the vertical deformation of the lock arm 25. Further, an operable piece 27 for disengaging the locking projection 4 from the engaging projection 3 projects behind the locking projection 4 on the upper surface of the lock arm 25. By pressing or operating the operable piece 27, the lock arm 25 can be elastically deformed in disengaging (downward) direction.

[0047] The front wall of the terminal retainer 15 serves as a front-stop wall 28 (as a preferred stop wall for stopping a movement of the terminal fitting 5 in an insertion or longitudinal direction) which is aligned and held in contact with the front surface of the housing head 14 when the terminal retainer 15 is fitted into the housing 9 and with which the front end surfaces of the respective female terminal fittings 5 are brought or bringable into contact. A plurality of male terminal insertion openings 29 which can be substantially aligned with the respective cavities 16 and windows 23 are formed in the front-stop wall 28.

[0048] The terminal locking portion 18 integrally or unitarily extends down from the ceiling surface of the terminal retainer 15 preferably substantially over the entire width. The terminal locking portion 18 is located in such a position that a distance from the inner surface of the front-stop wall 28 to the front surface of the terminal locking portion 18 (dimension or distance T shown in FIG. 10) is substantially equal to the entire length of the connecting portion 6 of the female terminal fitting 5 (distance from the front surface of the connecting portion 6 to the rear surface of the contact piece 11: dimension or distance S shown in FIG. 2). The same or corresponding number of communication holes 30 as the corresponding cavities 16 at the upper stage are formed in the terminal locking portion 18. As described later, when the terminal retainer 15 is mounted in a partial locking position in the housing 9 (see FIG. 12), the respective communication holes 30 are substantially aligned with the corresponding cavities 16 and lower parts of the opening edges or (peripheral) edge portions of the communication holes do not enter the respective cavities 16 at the lower stage. Thus, with the terminal retainer 15 in its partial locking position, insertion of the female terminal fittings 5 into the respective cavities 16 of the housing 9 is permitted. However, when the terminal retainer 15 is mounted in a full locking position in the housing 9 (see FIG. 1), the upper ends and lower ends of the opening edges or edge portions of the respective communication holes 30 enter the respective cavities 16 at the upper stage and those at the lower stage, respectively. Thus, as long as the female terminal fittings 5 are inserted to proper insertion position where they substantially abut against the front-stop wall 28, the terminal locking portion 18 prevents the female terminal fittings 5 from coming backward out of the cavities 16 by being held in close contact with the contact pieces 11.

[0049] Further, the terminal locking portion 18 can be brought into contact with the receiving pieces U of the corresponding female terminal fittings 5 when being located in the full locking position in the housing 9. Specifically, bottom end surfaces 18A of the terminal locking portion 18 and upper ends 18B of the opening edges or edge portions of the respective communication holes 30 are so formed as to be substantially horizontal, and the thickness thereof in forward and backward directions is set slightly longer than the receiving pieces U. Therefore, the bottom end surfaces 18A and the upper ends 18B can be brought into contact with the receiving pieces U of the female terminal fittings 5 substantially over their entire lengths of the receiving pieces U.

[0050] The opposite side walls of the terminal retainer 15 are formed with partial and full locking holes 31, 32 in such a manner as to corresponding to the partial and full locking projections 8a, 8b of the main body 17. Since the respective pairs of partial and full locking projections 8a, 8b are diagonally arranged or spaced in longitudinal direction with respect to each other as described above, the partial and full locking holes 31, 32 are correspondingly in a similar or corresponding arrangement. The partial locking holes 31 are oblong holes which are long in height direction. The partial locking projections 8a are or can be engaged with the bottom edges of the partial locking holes 31 as shown in FIG. 17 with the terminal retainer 15 in the partial locking position, whereas they are located in intermediate positions of the partial locking holes 31 (see state shown by phantom line in FIG. 17) with the terminal retainer 15 in the full locking position. On the other hand, the full locking projections 8b are or can be engaged with stepped portions below the bottom ends of the opening edges of the full locking holes 32 as shown in FIG. 18 with the terminal retainer 15 in the partial locking position, whereas they are located in the full locking holes 32 with the terminal retainer 15 in the full locking position (see state shown by phantom line in FIG. 18).

[0051] The pair of coupling projections 34 are formed at the rear end of the opposite side surfaces of the terminal retainer 15, and are insertable into the guide grooves 33 of the housing 9.

[0052] Next, the function and effect of this embodiment thus constructed are specifically described. In the case of assembling the female connector housing F, the housing head 14 is first at least partly accommodated in the bulging portion 20 of the main body 17. At this

stage, the hooking projections 24 of the housing head 14 are engaged with (or may be pressed into) the notches 21 of the main body 17.

[0053] The terminal retainer 15 is at least partly fitted into the housing 9 assembled with the housing head 14 laterally or from above while the coupling projections 34 are being substantially aligned with the guide grooves 33. At this stage, the terminal locking portion 18 of the terminal retainer 15 is fitted into the mount hole 19 of the main body 17. Further, the partial locking projections 8a are engaged with the partial locking holes 31 and the full locking projections 8b are engaged with the stepped portions below the full locking holes 32. Accordingly, the terminal retainer 15 is prevented from moving further down in the housing 9 and moving upward to come out. In other words, the terminal retainer 15 is held in the partial locking position with respect to the housing head 14 and the housing 9 (state shown in FIGS. 12, 13 and 15).

[0054] In the partial locking position, the communication holes 30 of the terminal retainer 15 are substantially aligned with the cavities 16, but the male terminal insertion openings 29 formed in the front-stop wall 28 are substantially not aligned with the cavities 16 and the front-stop wall 28 is held in close contact with the front surface of the main body 17. Accordingly, upon being inserted into the respective cavities 16 from behind, the female terminal fittings 5 can pass through the communication holes 30 in the cavities 16 at the upper stage and can pass below the terminal locking portion 18 in the cavities 16 at the lower stage. When being further pushed in, the female terminal fittings 5 pass the respective locking portions 10 while elastically deforming them downward and come into abutment against the rear surface of the front-stop wall 28. In this way, the front end positions of the female terminal fittings 5 are determined. Since the respective locking portions 10 are elastically restored to engage the engaging projections 8 after the female terminal fittings 5 are inserted to their proper insertion positions, the female terminal fittings 5 are partly locked in the female connector housing F so as not to come out.

[0055] Upon completion of insertion of the female terminal fittings 5 as above, the terminal retainer 15 is pushed into the housing 9 and the housing head 14 to bring the ceiling surface thereof into close contact with the upper surface of the main body 17. This causes the partial locking projections 8a to move to the intermediate positions in the partial locking holes 31 and the full locking projections 8b to engage the full locking holes 32. In this way, the terminal retainer 15 is locked in the housing 9 so as not to come out. In the full locking position, the upper ends of the opening edges or edge portions of the communication holes 30 and the bottom end of the terminal locking portion 18 respectively enter the respective cavities 16 at the upper and lower stages as described above and lock the female terminal fittings 5 while being held in close contact with the contact pieces 11 thereof. Simultaneously, the bottom end of the terminal locking portion 18 and the upper ends of the opening edges or edge portions of the communication holes 30 are brought into contact with the upper edges of the receiving pieces U of the corresponding female terminal fittings 5. As a result, the respective female terminal fittings 5 are so held as not to shake in the cavities 16.

[0056] Further, the insertion openings 29 of the front-stop wall 28 are aligned with the respective cavities 16 at this stage.

[0057] When the terminal retainer 15 reaches the full locking position, the male terminal insertion openings 29 of the front-stop wall 28 are substantially aligned with the respective cavities 16.

[0058] If the female terminal fitting 5 stops far before its proper insertion position, the terminal locking portion 18 is interfered by the upper surface of the female terminal fitting 5 and cannot be pushed in. Thus, an operator immediately notices that the female terminal fitting 5 is insufficiently inserted, and inserts it to the proper insertion position.

[0059] However, if the female terminal fittings 5 are inserted to the proper insertion positions where they abut against the front-stop wall 28, the terminal locking portion 18 can lock the female terminal fittings 5 while being held in close contact with the connecting portions 6 thereof as long as the female terminal fittings 5 are produced in specified dimensions since the distance between the front-stop wall 28 and the terminal locking portion 18 is set substantially equal to the entire length of the connecting portion 6 of the female terminal fittings 5, i.e. the distance between the front surfaces of the connecting portions 6 and the rear surface of the contact pieces 11.

[0060] After the female terminal fittings 5 are accommodated in the female connector housing F while being doubly locked by the locking portions 10 and the terminal locking portion 18, the female connector housing F is at least partly fitted or fittable into the male connector housing M. As the female connector housing F is fitted into the male connector housing M, the locking projection 4 of the lock arm 25 comes into contact with the engaging projection 3 of the male connector housing M. As the housings F, M are further fitted, the lock arm 25 is elastically deformed downward and the locking projection 4 engages the engaging projections 3 for locking preferably after slipping under it, with the result that the housings F, M are locked into each other. In the case of effecting unlocking of the housings F, M, the engaging projection 3 and the locking projection 4 can be disengaged from each other if the lock arm 25 is elastically deformed again by pushing the operable piece 27.

[0061] As described above, according to this embodiment, the terminal locking portion 18 is or can be brought in contact with the upper edges of the receiving pieces U of the respective female terminal fittings 5 with the terminal retainer 15 in its full locking position. Thus, even if vibration of an automotive vehicle or the like is

transmitted to the female terminal fittings 5 e.g. via the wires W, a problem of fine sliding abrasion can be securely avoided since the female terminal fittings 5 are so held as not to shake in the cavities 16. Further, in this embodiment, the receiving pieces U are arranged before the barrel portions as seen in a longitudinal direction from a mating side of the terminal fitting 5 i.e. a side where the terminal fitting 5 is mated with a mating terminal fitting 1 or in a position between the barrel portions 12, 13 and the connecting portion 6s, i.e. the terminal fittings are not held in such positions where the heights of their upper ends vary if the diameters of the wires W vary or the diameters of the crimped barrel portions 12, 13 vary due to varying diameters of the wires W. Therefore, the receiving pieces U and the terminal locking portion 18 can be brought into contact with each other regardless of the diameters of the wires.

[0062] In addition, in this embodiment, the terminal retainer 15 is provided with a function of determining the front end positions of the female terminal fittings 5, a function of preventing the female terminal fittings 5 from coming out of the cavities 16 by means of the terminal locking portion 18 and a function of pressing the female terminal fittings 5 so as not to shake. Thus, there is an additional effect of a simpler construction of the connector by reducing the number of the parts thereof.

[0063] In other words, when the terminal retainer 15 is mounted in a full locking position in the housing 9, the terminal locking portion 18 formed on the terminal retainer 15 comes into contact with the upper edges of receiving pieces U of female terminal fittings 5. Since the female terminal fittings 5 are so held as not to shake in cavities 16, a problem of fine sliding abrasion can be solved. Further, since the receiving piece U is formed before or in the neighourhood of the barrel portions 12, 13, it is not influenced by a variation of the outer diameter of a wire W to be connected. Therefore, the terminal locking portion 18 can be securely brought into contact with the receiving pieces U.

[0064] As described above, according to this embodiment, a spacing between the front-stop wall 28 and the terminal locking portion 18 is fixedly set at the entire length of the connecting portion 6 of the female terminal fitting 5 since the front-stop wall 28 and the terminal locking portion 18 are integrally or unitarily formed at the terminal retainer 15. In the prior art connector, a dimensional variation was unavoidable from an assembling ground since the retainer was separately formed, which resulted in the shake of the female terminal fittings 5. However, the connector according to this embodiment can securely avoid such a problem. As a result, this connector is protected from fine sliding abrasion. Further, since the contact pieces 11 are provided and the guide surfaces 11a for guiding the terminal locking portion 18 are formed thereon in this embodiment, the leading end of the terminal locking portion 18 is smoothly guided backward while sliding on the guide surfaces 11a when the terminal retainer 15 is moved to its full locking position, with the result that the locking action can be easily carried out.

[0065] Various changes can be made in the present invention, and following modifications are also embraced by the technical scope of the present invention as defined in the claims.

(1) Although the present invention is applied to the female connector housing F in the foregoing embodiment, it may be applied to the male connector housing M.

(2) Although the housing 9 is comprised of the main body 17 and the housing head 14 in the foregoing embodiment, it may have an unitary or integral construction.

(3) The housing 9 is formed with two stages of cavities in the shown embodiment, the number of the stages of cavities is not limited, wherein there may be only one or three or more stages.

(4) The contact piece of the terminal fitting may have a springback so as to be elastically deformable substantially in forward and backward or longitudinal directions. With such a contact piece, even if the distance from the leading end of the terminal fitting to the contact piece varies, the contact piece and the terminal locking portion are elastically engaged with each other. As a result, the above variation can be taken up.

(5) Although the lock arm is formed on the terminal retainer in the foregoing embodiment, it may be formed on the housing.

(6) Although the guide surface 11a is formed on the female terminal fitting 5 in the foregoing embodiment, it may be formed on the terminal locking portion 18 of the terminal retainer 15.

(7) Although the guide surface 11a is slanted in the foregoing embodiment, it may be a moderate arcuate surface.

(8) The height of the receiving piece U may be adjustable. For example, if the upper end of the receiving piece U may be turned inwardly in U-shape along its width to provide a springback so that the height of the upper end of the receiving piece U is adjustable, the terminal locking portion 18 and the receiving piece U can be securely brought into contact with each other by taking up variations from a manufacturing or assembling ground.

(9) Although the terminal locking portion 18 is integrally or unitarily formed with the terminal retainer 15, they may be separately formed.

LIST OF REFERENCE NUMERALS

[0066]

5	(female) terminal fitting
9	housing
11	contact piece (as a preferred engaging por-

	tion)
11a	guide surface
12, 13	wire connecting portion
15	terminal retainer (as a preferred terminal fixing device)
16	cavity
18	terminal locking portion
19	opening
28	front-stop wall
F	(female) connector housing
U	receiving piece

Claims

1. A shake preventing construction for a terminal fitting (5), comprising:

   at least one terminal fitting (5) formed at its rear part with a wire connecting portion (12; 13) to be connected with a wire (W),
   a connector housing (F) provided with at least one cavity (16) for at least partly accommodating the terminal fitting (5), and
   a terminal fixing device (15) mountable in the connector housing (F) and having a contact portion (18) for coming into contact with the terminal fitting (5) in a position (U) before the wire connecting portion (12; 13) to prevent the terminal fitting (5) from shaking.

2. A shake preventing construction according to claim 1, wherein the terminal fixing device (15) comprises a locking portion (18) for locking the terminal fitting (5) to prevent the terminal fitting (5) from coming out of the cavity (16).

3. A shake preventing construction according to one or more of the preceding claims, wherein the terminal fixing device (15) is formed with a front-stop wall (28) with which the front end surface of the terminal fitting (5) is brought or bringable into contact for determining a front end position of the terminal fitting (5).

4. A shake preventing construction according to one or more of the preceding claims, wherein the terminal fitting (5) comprises a connecting portion (6) to be connected with a mating terminal fitting (1), and a receiving piece (U), which can be brought into contact with the contact portion (18), between the connecting portion (6) and the wire connecting portion (12; 13).

5. A shake preventing construction according to one or more of the preceding claims, wherein at least one of the terminal fitting (5) and the contact portion (18) of the terminal fixing device (15) are formed with a guide surface (11 a) for guiding a locking operation of the terminal fixing device (15).

6. A shake preventing construction according to one or more of the preceding claims, wherein the terminal fixing device (15) can be positioned in a partial lock position (FIG. 12) at least one communication hole (30) provided therein is substantially in flush with the corresponding cavity (16) whereby the terminal fitting (5) can be inserted into the cavity (16) and the communication hole (30), whereas when the terminal fixing device (15) is positioned in a full locking position (FIG. 1) the contact portion (18) comes into contact with the terminal fitting (5) thereby locking the terminal fitting (5) in the cavity (16).

7. A shake preventing construction according to one or more of the preceding claims, wherein corresponding portions (18A, 18B) of one contact portion (18) enter at least two adjacent cavities (16) when the terminal fixing device (15) is positioned in the full locking position (FIG. 1).

8. A shake preventing construction according to one or more of the preceding claims, wherein the terminal fitting (5) is provided with locking means (8) interacting with mating locking means (10) provided in the connector housing (F) so as to provide secondary locking means for locking the terminal fitting (5) in the connector housing (F).

9. A connector, comprising:

   at least one terminal fitting (5) formed with a engaging portion (11) in a position spaced from a leading end (6) thereof by a specified distance (S),
   a housing (F) having at least one cavity (16) for at least partly accommodating the terminal fitting (5) along its longitudinal direction, and
   a terminal retainer (15) at least partly mountable into the housing (F), having a front-stop wall (28) which is to be located substantially at the front end of the cavity (16) and is to be held substantially in contact with the leading end (6) of the terminal fitting (5), and integrally or unitarily provided with a terminal locking portion (18) which is located at a position spaced from the front-stop wall (18) by a specified distance (T) and engageable with the engaging portion (11).

10. A connector according to claim 9, wherein the cavity (16) is formed with an opening (19) for substantially exposing the engaging portion (11) to the outside.

11. A connector according to claim 9 or 10, wherein the specified distance (S) by which the engaging portion (11) is spaced from the leading end of the ter-

minal fitting (5) and the specified distance (T) by which the locking portion (18) is spaced from the front-stop wall (28) is substantially the same.

12. A connector according to one or more of the preceding claims 9 to 11, wherein at least one of the engaging portion (11) of the terminal fitting (5) and the terminal locking portion (18) of the terminal retainer (15) is formed with a guide surface (11a) for guiding a locking action of the terminal locking portion (18) of the terminal retainer (15).

13. A connector according to one or more of the preceding claims 9 to 12, wherein the terminal retainer (15) is movable between a partial locking position (FIG. 12) where it is held in the housing (F) so as not to hinder insertion of the terminal fitting (5) into the cavity (16) and a full locking position (FIG. 1) where the terminal locking portion (18) is substantially engaged with the engaging portion (11) of the terminal fitting (5) to prevent the terminal fitting (5) from coming out of the cavity (16), in particular backwardly.

14. A connector according to one or more of the preceding claims 9 to 13, wherein the terminal fitting (5) comprises a connecting portion (6) at the leading end thereof for the connection with a mating terminal fitting (M), the connecting portion (6) defining the specified distance (S) and comprising the engaging portion (11).

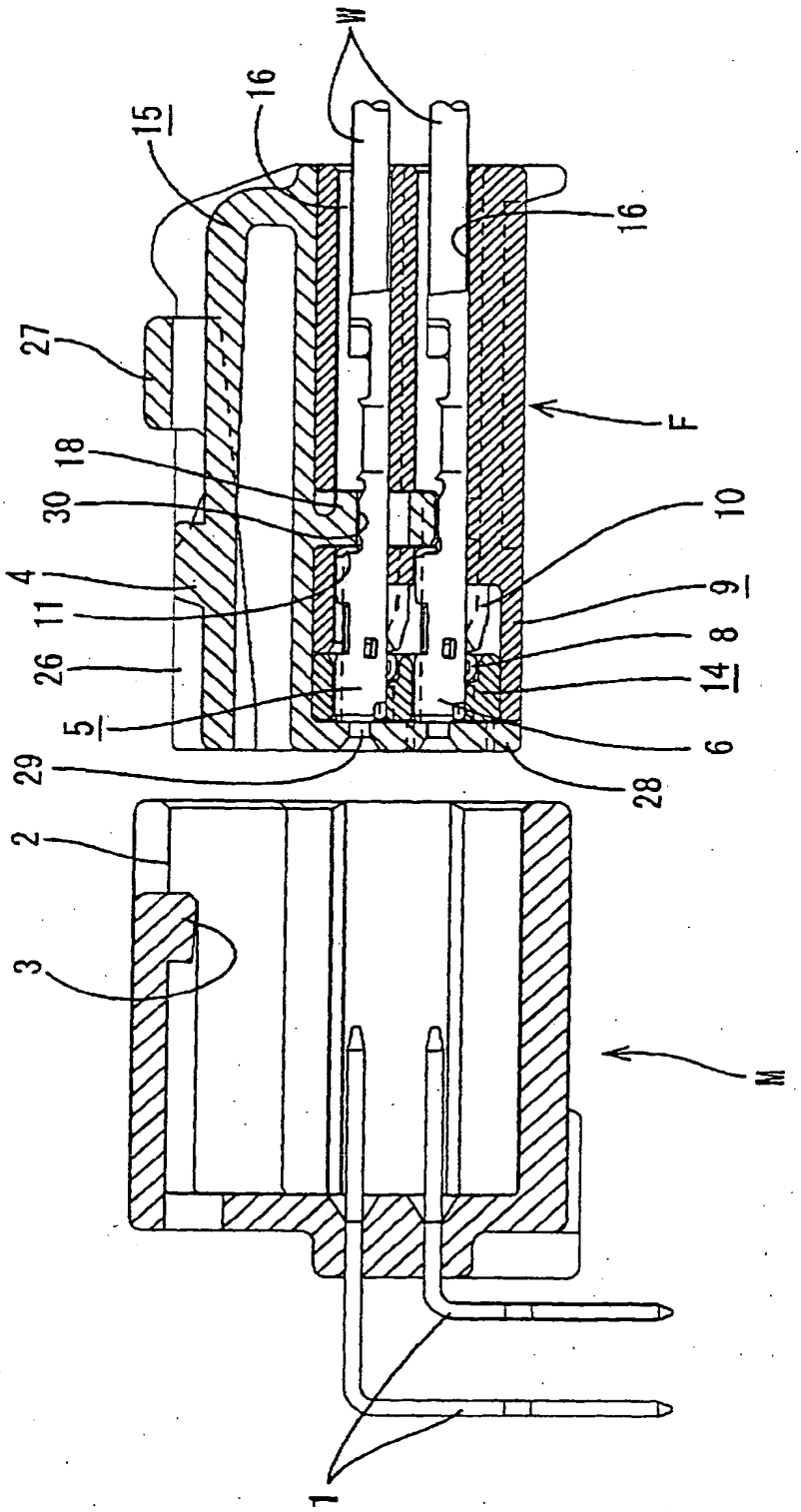

FIG. 1

FIG. 2

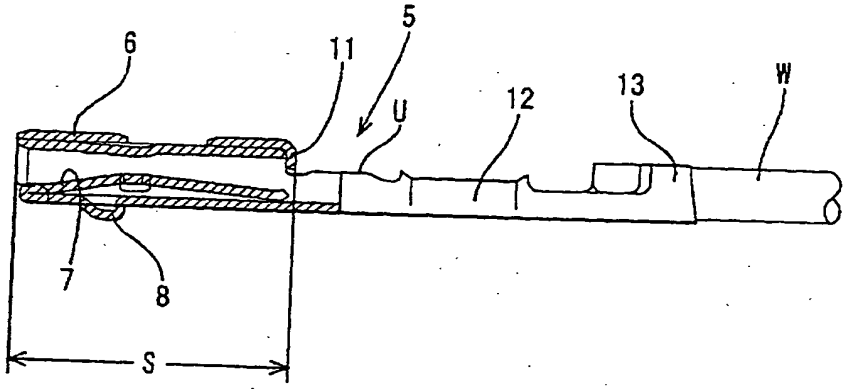

FIG. 3

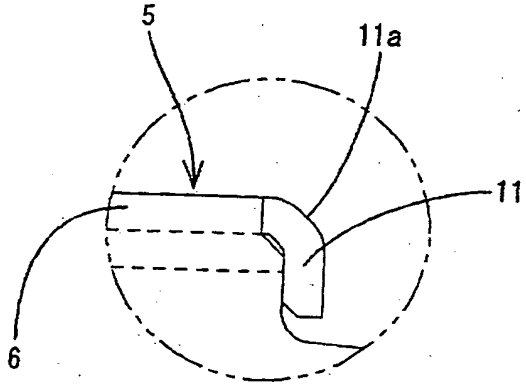

FIG. 4

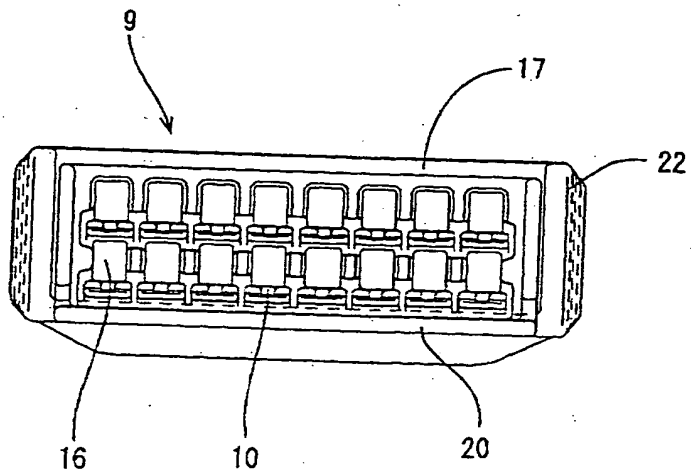

FIG. 5

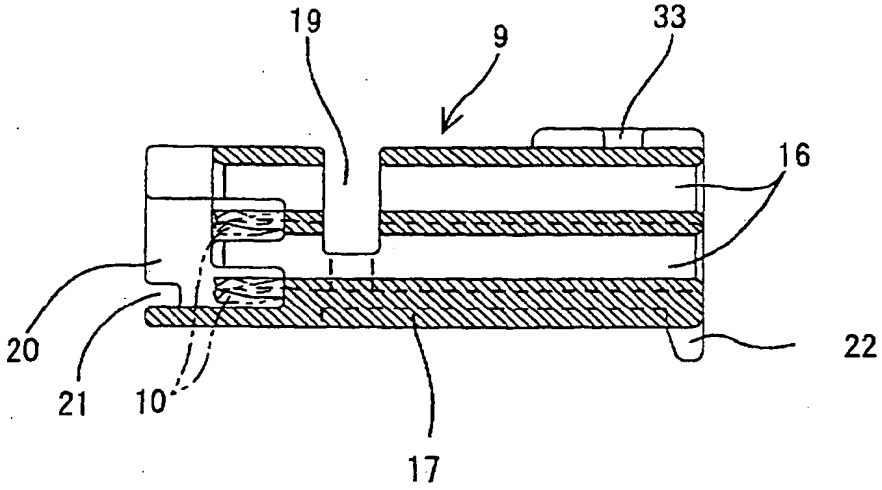

FIG. 6

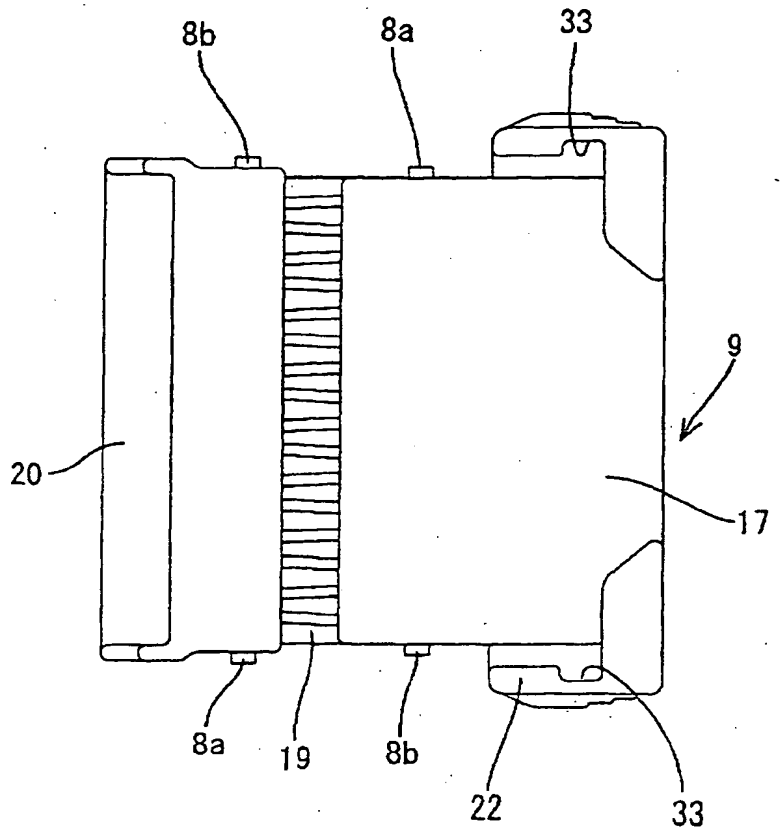

FIG. 7

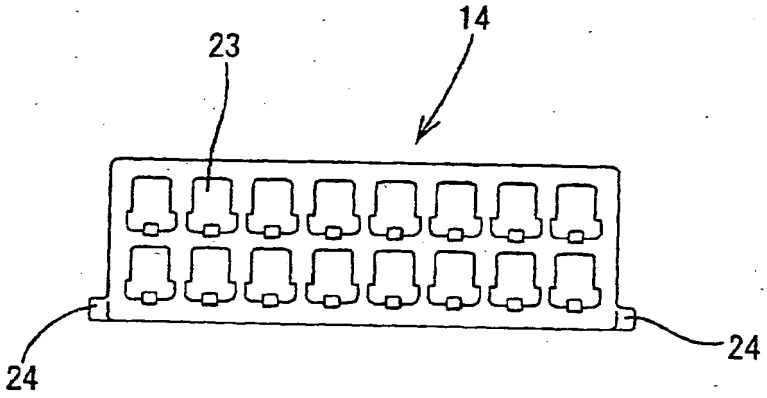

FIG. 8

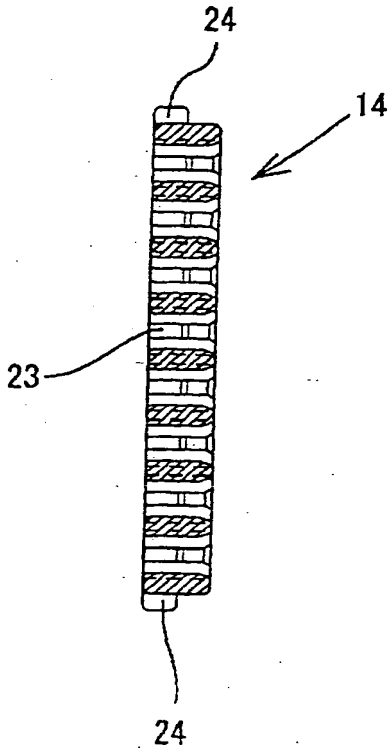

FIG. 9

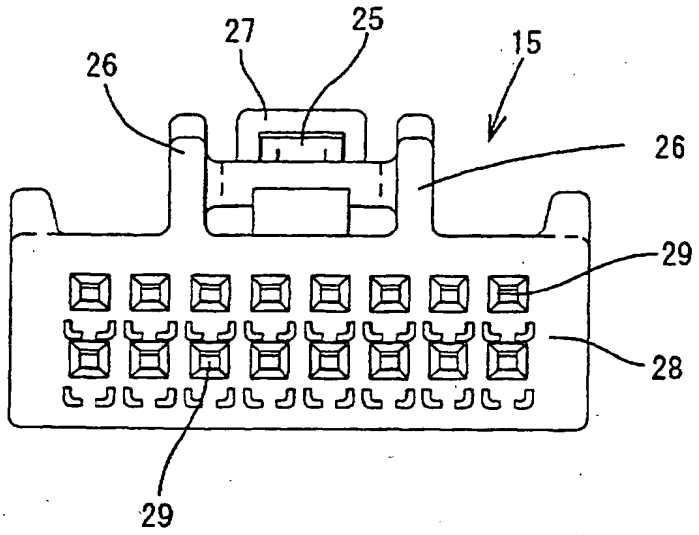

FIG. 10

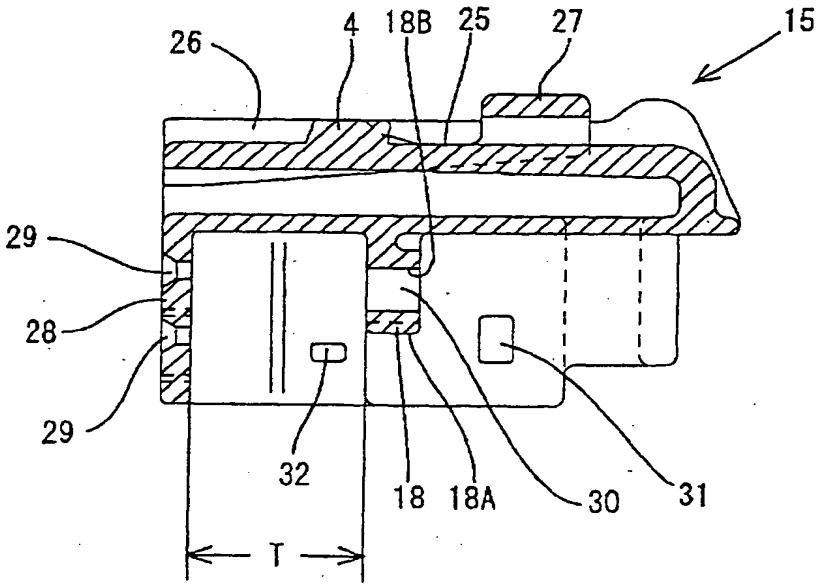

FIG. 11

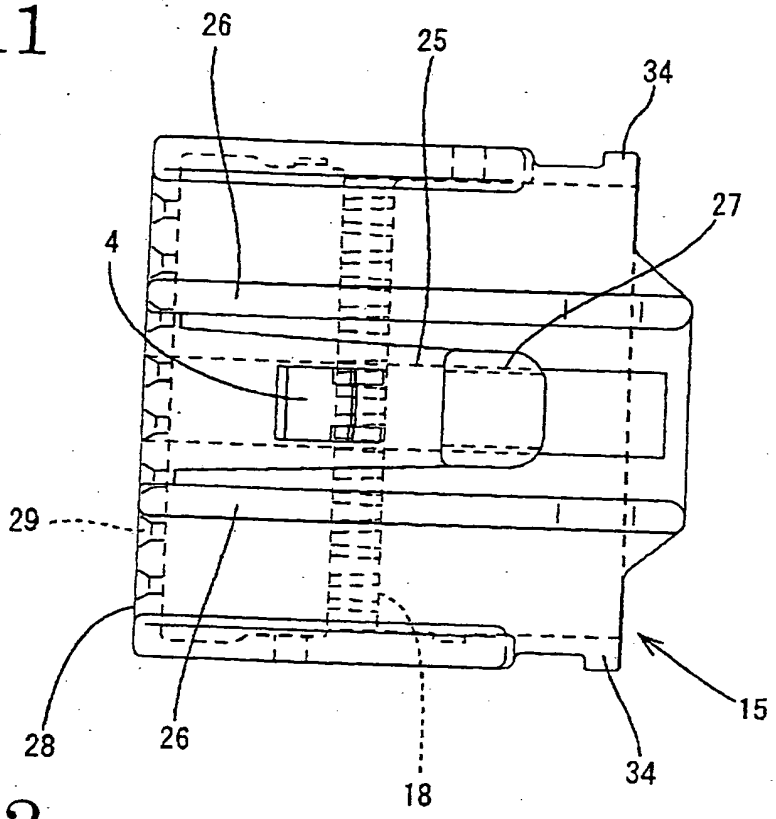

FIG. 12

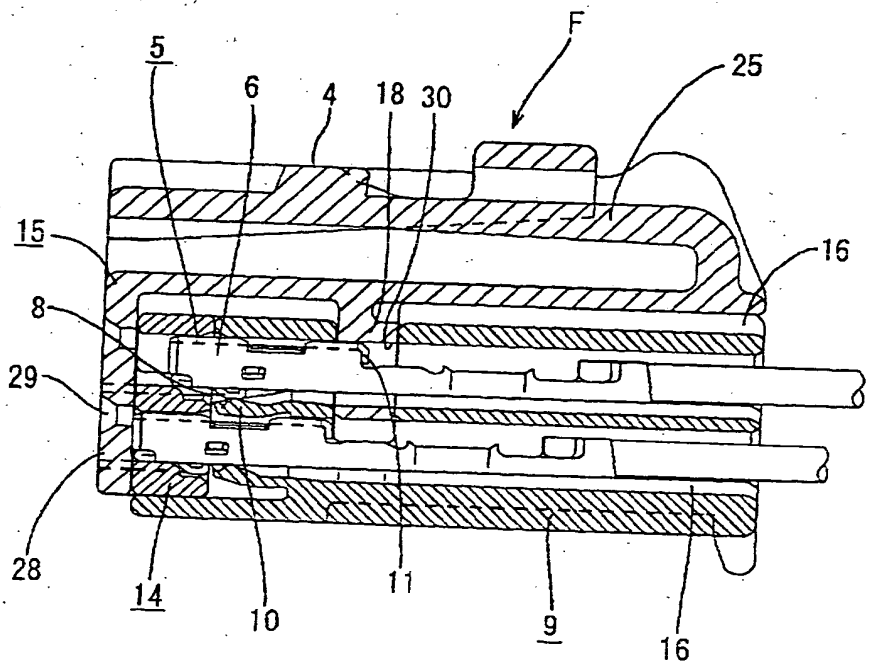

FIG. 13

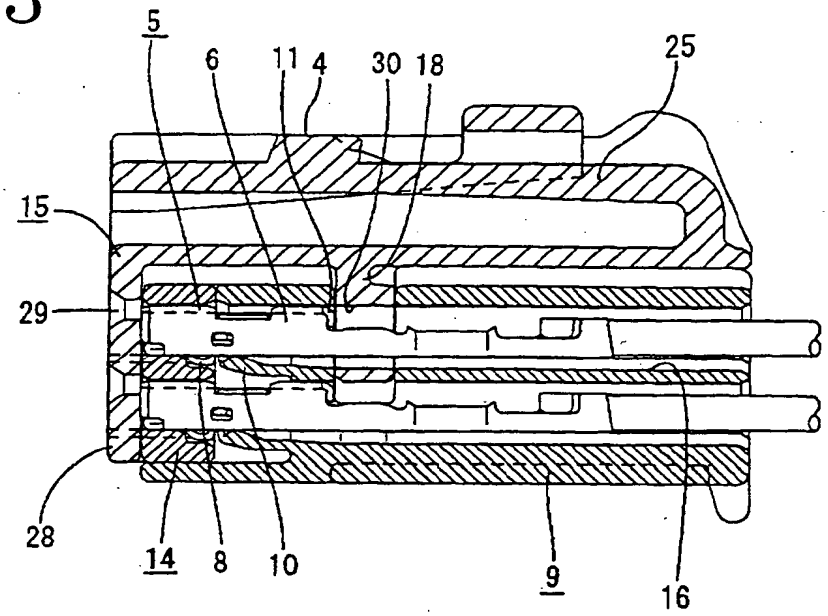

FIG. 14

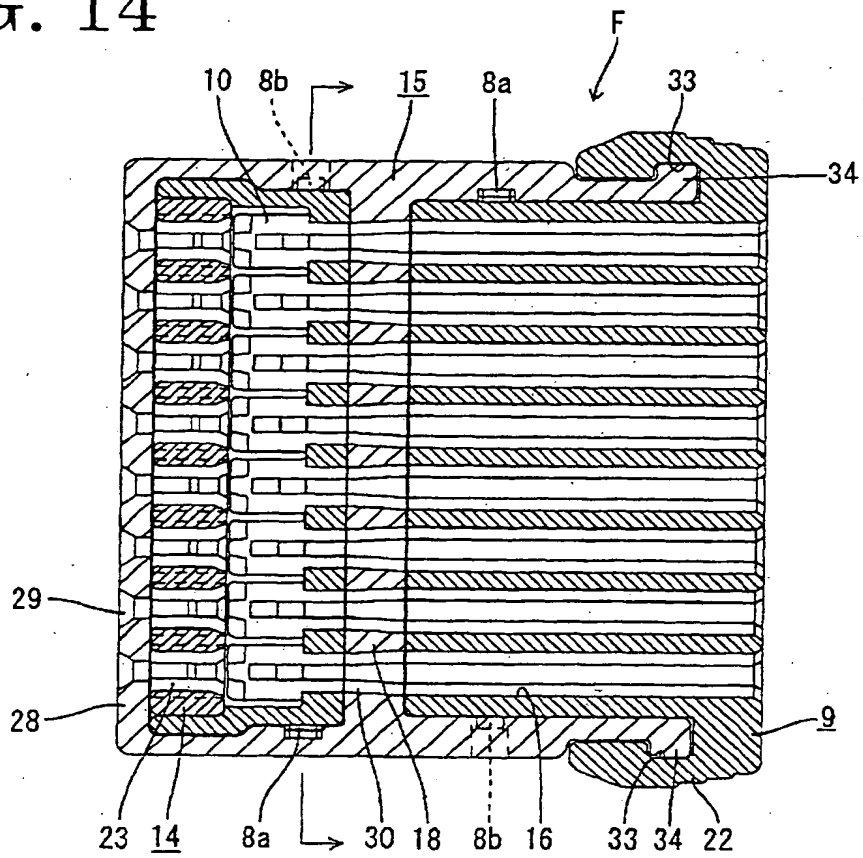

FIG. 15

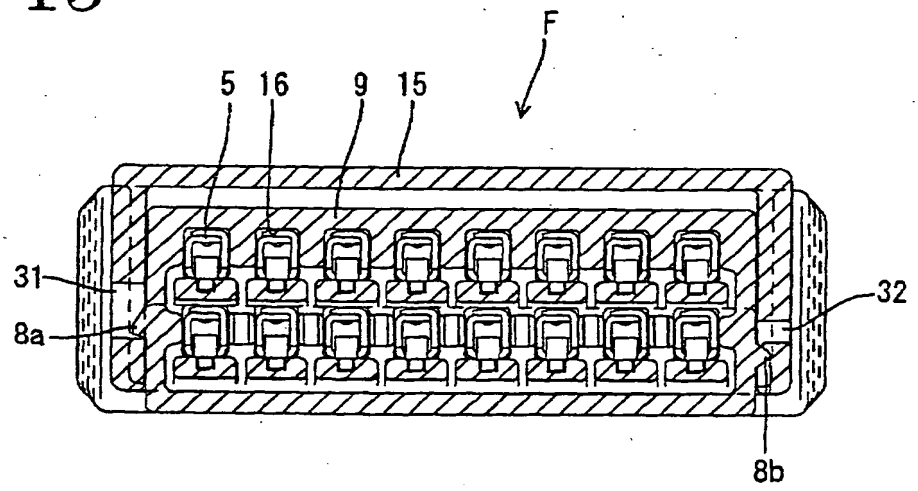

FIG. 16

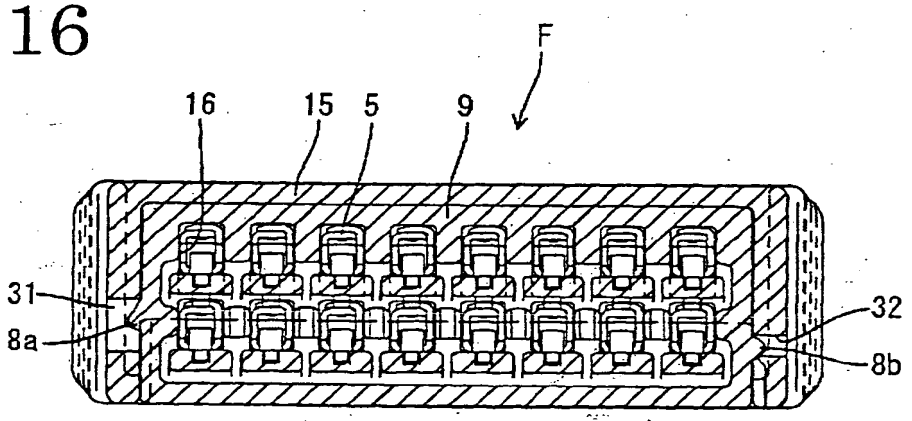

FIG. 17

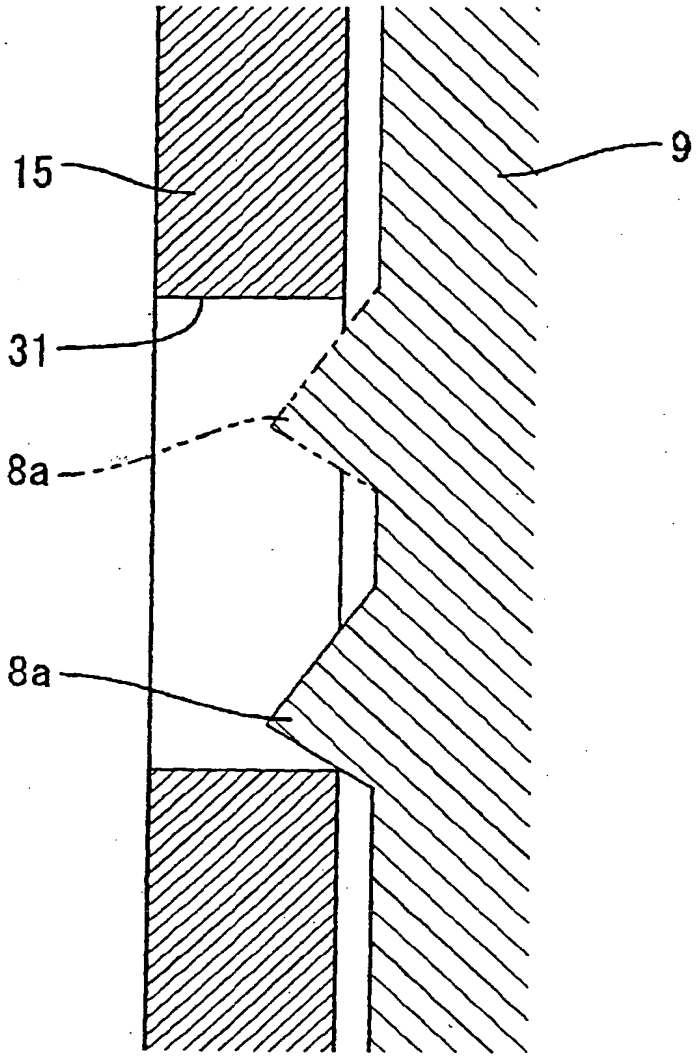

FIG. 18

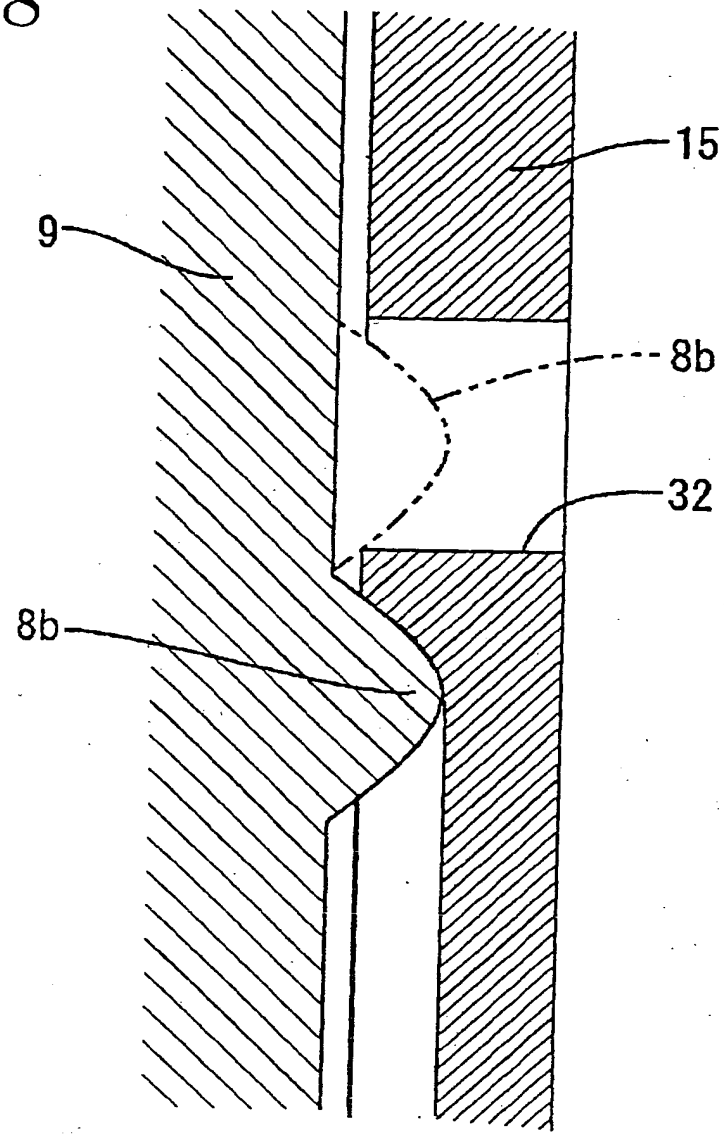

FIG. 19

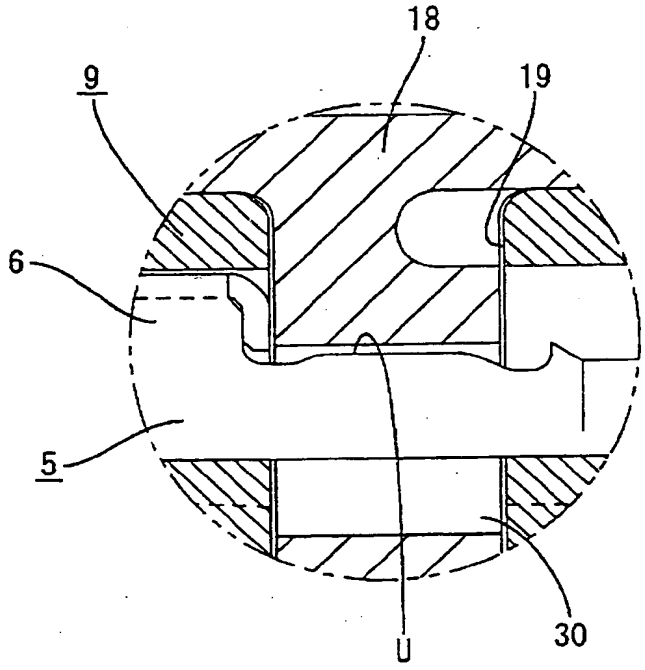

FIG. 20
PRIOR ART